

# Chapter 7

## Neuropsychological and Cognitive Control Deficits in Depression

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### **ABSTRACT**

*The chapter explores the research done so far on neuropsychological deficits in major depressive disorder (MDD). The most prominent deficits have been reported in executive function and the cognitive control networks. These deficits have also been shown to affect various cognitive aspects of a patient, such as metacognitions and emotional regulation. They are also predictors of socio-occupational functioning and of recovering and relapse in patients. This makes it pertinent that these newer treatments for MDD account for these deficits and work on ameliorating them for long-term gains.*

### **INTRODUCTION**

Major Depressive Disorder (MDD) is a chronic disease prevalent worldwide. It impairs daily functioning, induces depressive thoughts, and reduces the quality of life. It has also shown to increase risks of acquiring cardiovascular disease, increase morbidity and mortality (Seligman & Nemeroff, 2015). More than 300 million individuals in the world are estimated to be affected by depression. The World Health Organisation (WHO) recognises it as a major public health crisis (Ferrari et al., 2013) and as the largest factor contributing to global disability (Smith et al., 2014).

Liu et al. (2019) found that the number of cases of depression worldwide increased by 49.86% from 1990 to 2017. It affects 16% of the global population (Kessler et al., 2003). WHO has predicted that by 2030, MDD will become the leading cause of disability in the world (Yang et al., 2015). In India, the National Mental Health Survey 2015-16 revealed that approximately one in every 20 Indians suffers from depression. It is estimated that in 2012, India had over 258,000 suicides, with the age-group of 15-49 years being most affected.

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## **BACKGROUND**

MDD is an illness characterized by low mood, loss of interest, difficulty in concentration and easy fatigability. Whilst depressed mood and loss of interest are one of the key features, other cognitive symptoms indicate the severity and character of the episode and contribute to significant functional impairment and impact recovery. Neurocognitive dysfunction is now understood to be central to depression. Deficits are reported mainly in cognitive control functions such as, attention, working memory and other executive functions (EF), which are harbingers of cognitive biases and metacognitive deficits (Shallice, 1996; Vinogradov, Fisher, & De Villers-Sidani, 2012).

Though depression is characterized as an episodic illness, prospective studies have found that most patients have a recurrence (Mueller et al., 1999). Researchers have noted a distinct ruminative form of thinking in patients suffering from MDD. Ruminations are defined as focused attention on symptoms of one's distress, and on its possible causes and consequences, as opposed to its solutions (Nolen-Hoeksema, 1991). From a neuropsychological perspective rumination may be understood as a result of failure to generate an adaptive response by the executive, top down systems controlling limbic activations (Marchetti et al., 2012; Pisner, 2018).

Cognitive control is the ability to control the contents of working memory (WM), which therefore might play an important role in recovery from negative affect. It involves the WM's ability to maintain what is currently of importance, allow response inhibition (RI) to filter what is less relevant and mental flexibility to change a line of thought/action to suit the goal. Reduced cognitive control over attention plays a major role in the diagnosis of depression (Dean & Keshavan, 2018).

EF ability is also linked to metacognition and emotional strategy selection (Ochsner & Gross, 2005). Activation of prefrontal control mechanisms have specifically been linked with attenuation of emotional responses (Siegle, Ghinassi, & Thase, 2007). These are known to persist after episodic recovery of depression disorder. Effective emotional and self-control has been linked to metacognition (Manser, Cooper, & Trefusis, 2012; Pennequin, Questel, Delaville, Delugre, & Maintenant, 2019). Both EF and Metacognition are now assumed to regulate deliberate, goal directed, and self-regulated information processing (Blair, Clancy & Diamond, 2008). When a need is created, the hot/emotional system urges the individual to approach desirable stimuli and the cool, cognitive system executes top-down control over the hot system and works towards achieving the desired goal (Metcalf & Mischel, 1999). Normally, the cool system helps a person to maintain pursuit of his/her initial goal by refraining from impulses, delaying gratification. Thus it is this cool system that overlaps EF.

## **Cognitive Control**

Cognitive control refers to mental processes that allow behaviour to vary adaptively depending on current goals. It is multifaceted, with one of its core functions being to override, restrain, or inhibit unwanted yet dominant response tendencies (Miyake et al., 2000). Cognitive control is recruited during low-level reaction time tasks, but also during complex self-regulatory behaviours (Hofmann, Schmeichel, & Baddeley, 2012). For example, cognitive control could involve inhibiting consistent reading responses on the Stroop test, limiting one's wish for unhealthy foods, or overcoming stereotypical associations of an ethnic community. Hence, cognitive control and its related aspects of self-regulation help us to hold on to long term goals in presence of counterproductive short term distractors. This mechanism is beneficial for individuals and society as it helps generate better outcomes.

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